OIPE JC22 JUL 0 2 2004 PATENT & TRADEMARK OFFICE

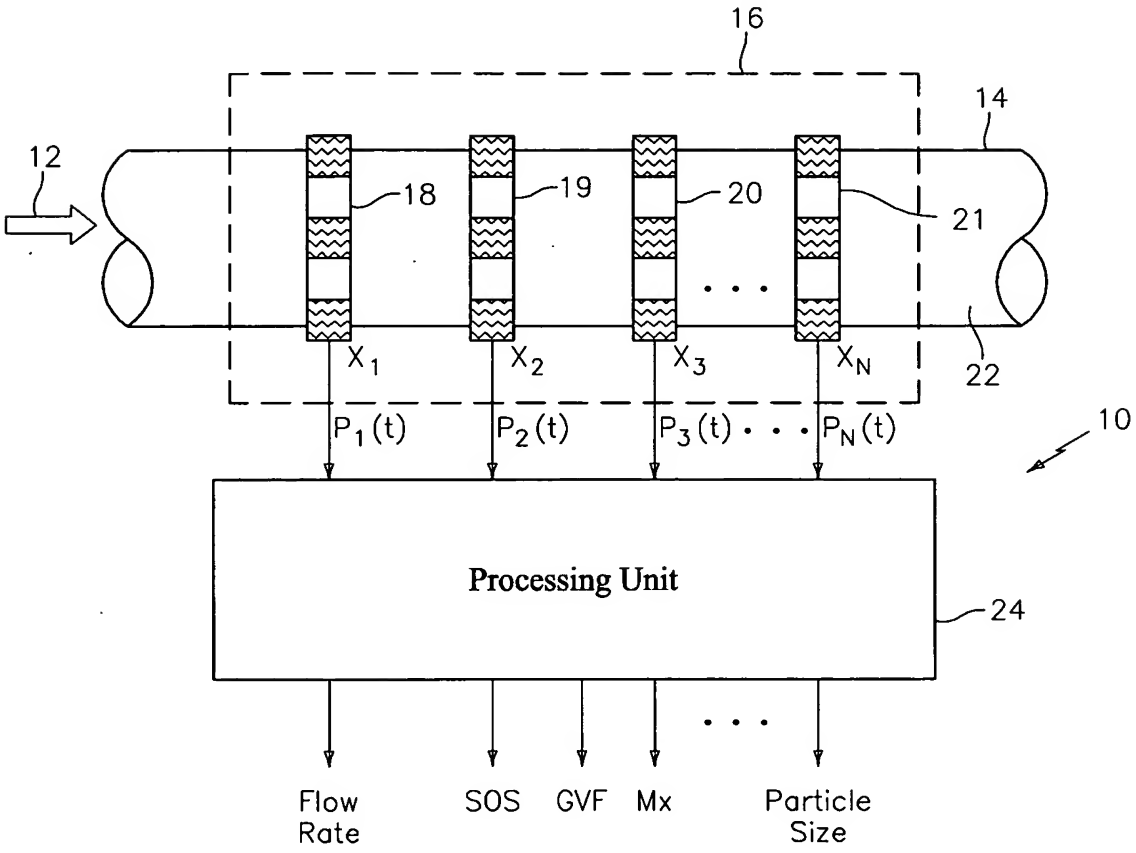

FIG. 1

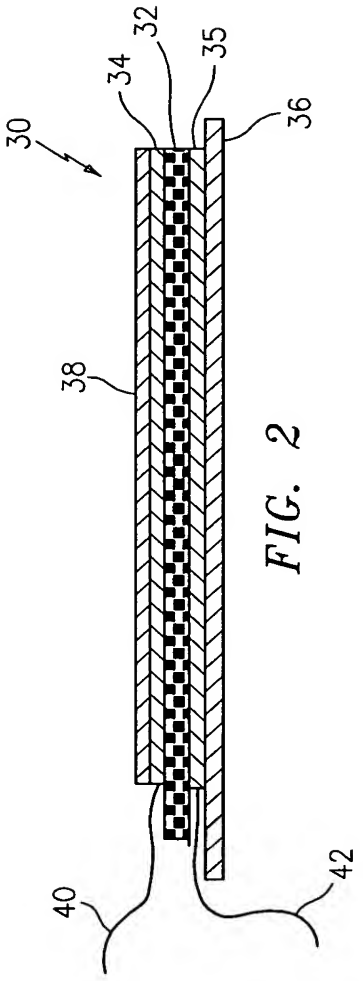

FIG. 2

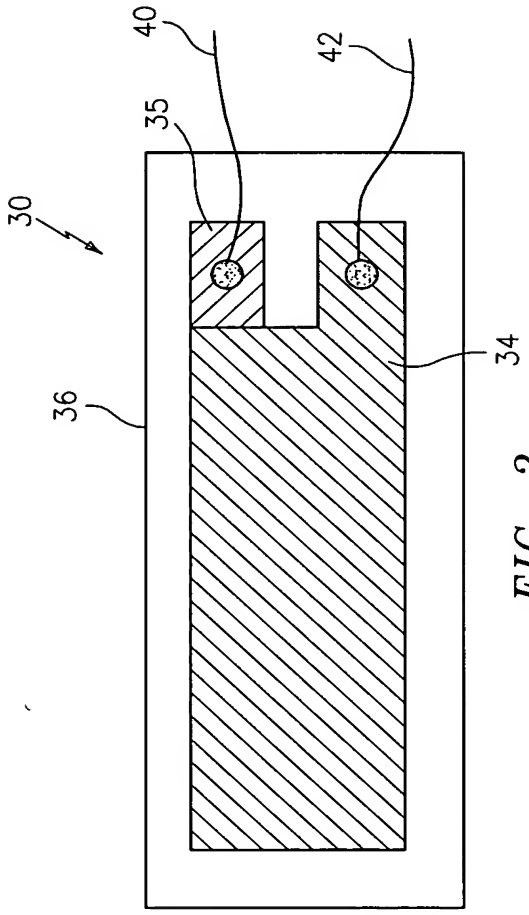

FIG. 3

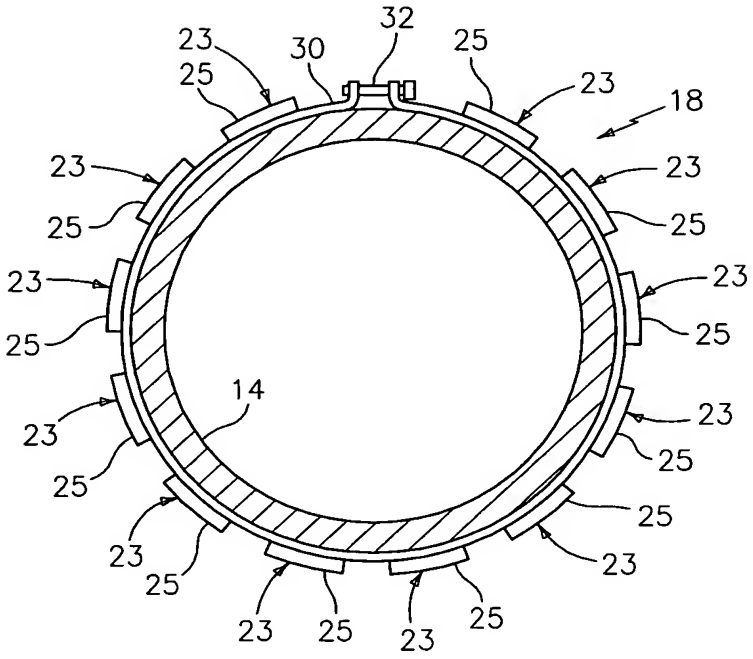
32
30
23
25
25
23
18
23
25
23
25
23
25
14
23
25
25
23
25
23
25
23
25
23

FIG. 4

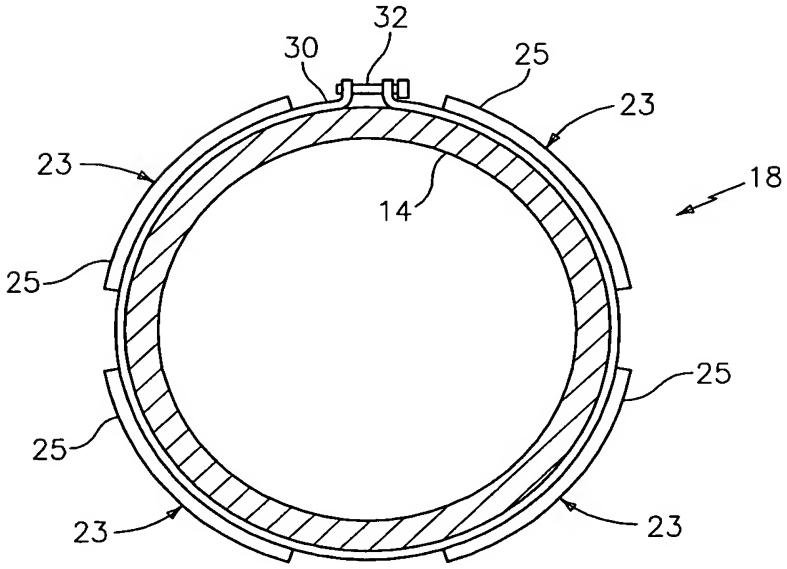
32
30
25
23
18
23
14
25
25
23

FIG. 5

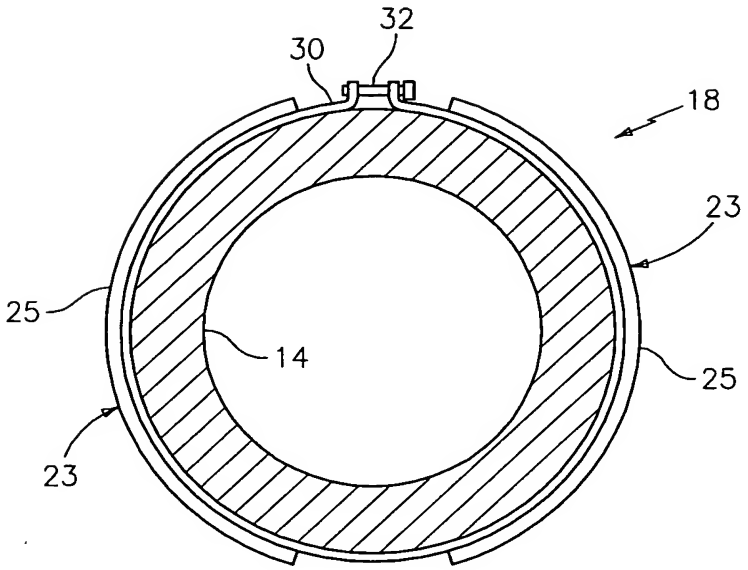

FIG. 6

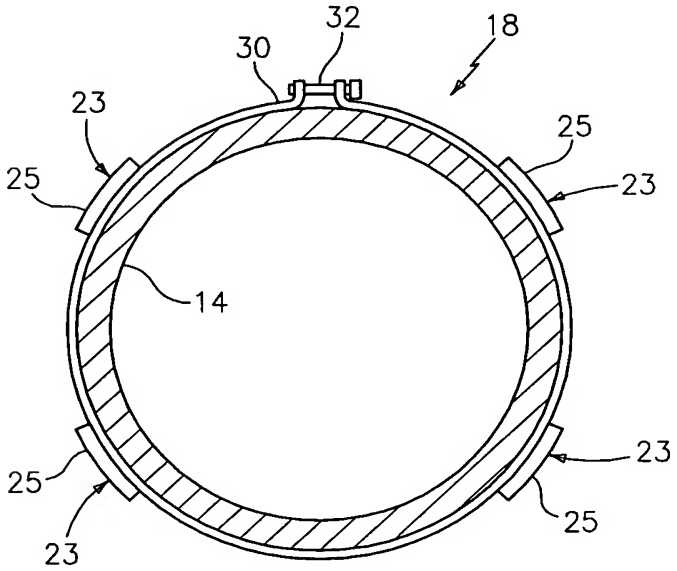

FIG. 7

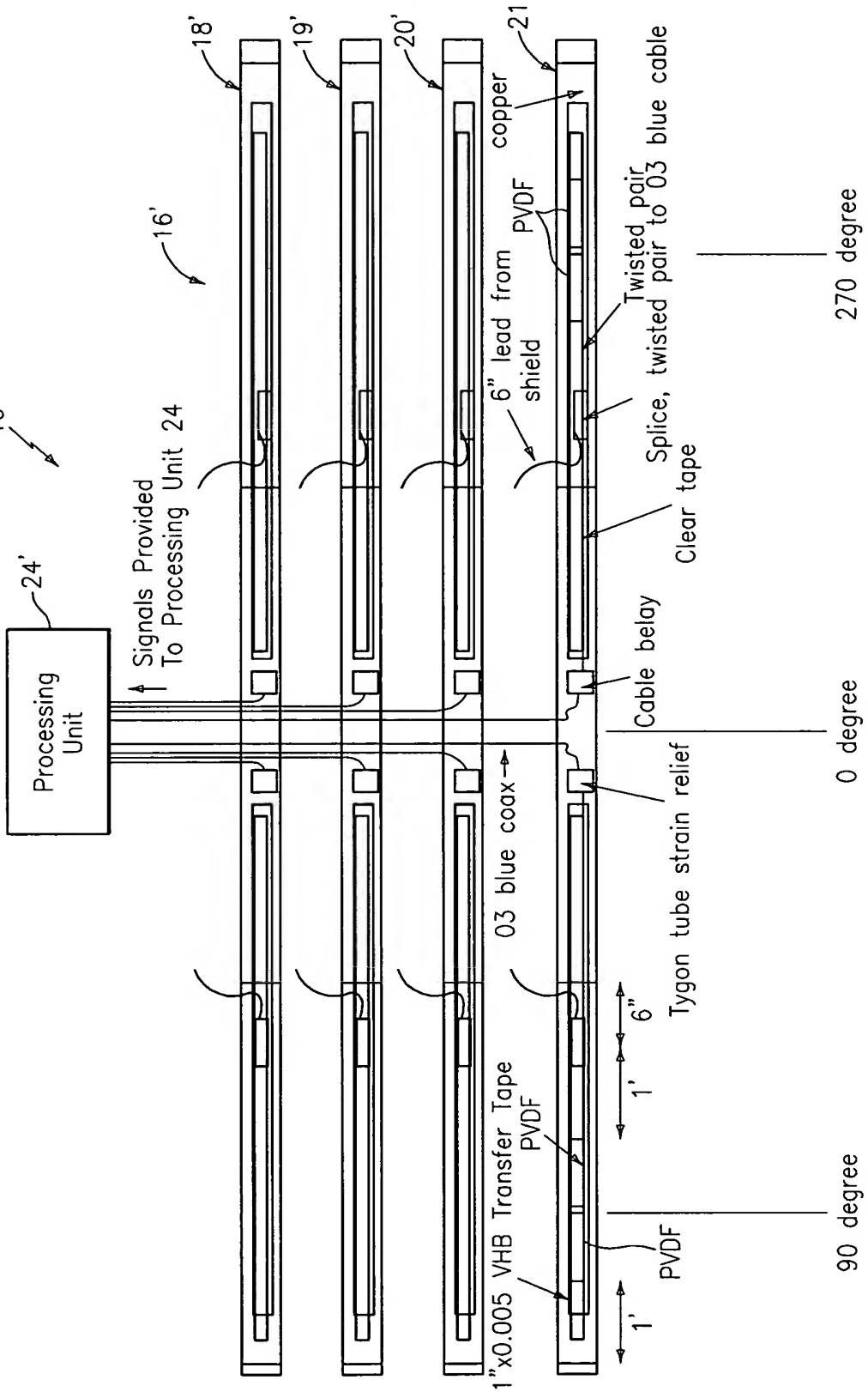
10'
16'
18'
19'
20'
21'
24'
Processing Unit
Signals Provided To Processing Unit 24
copper
PVDF
Twisted pair
Twisted pair to 03 blue cable
6" lead from shield
Splice, twisted pair to 03 blue cable
Clear tape
Cable belay
Tygon tube strain relief
03 blue coax
1"x0.005 VHB Transfer Tape
PVDF
PVDF
1'
6"
1'
270 degree
0 degree
90 degree

FIG. 8

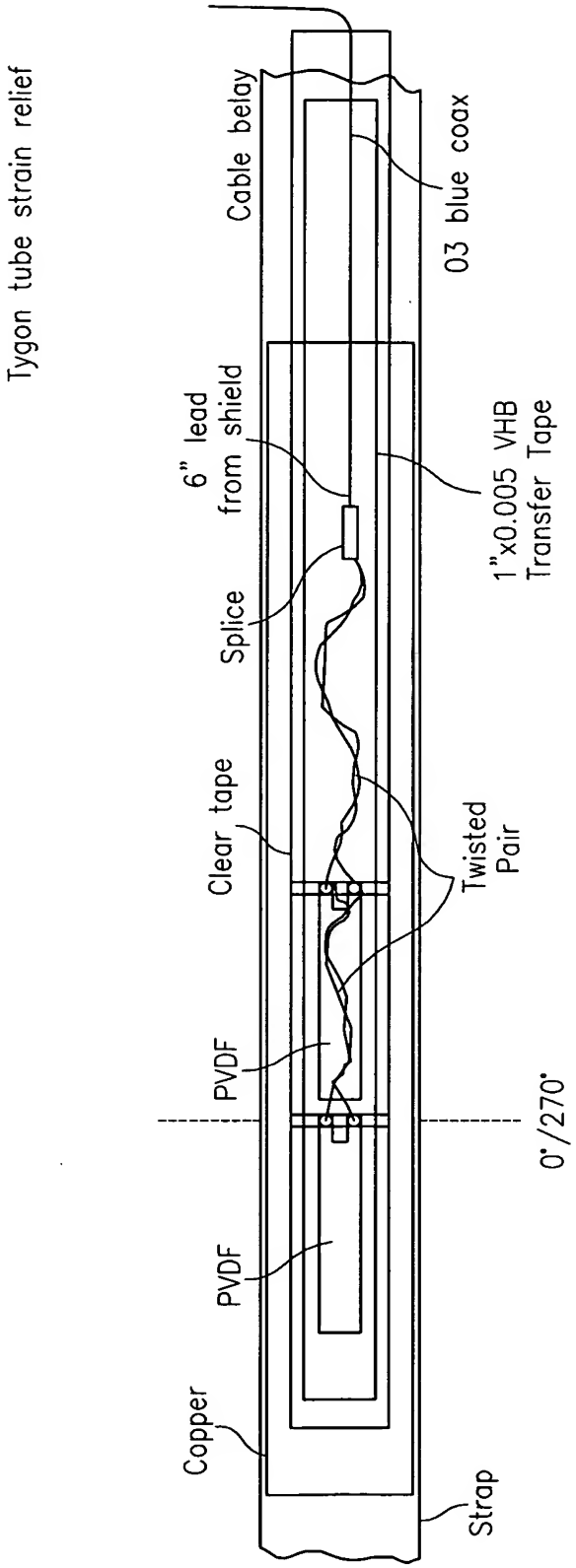
Tygon tube strain relief
Cable belay
03 blue coax
6" lead from shield
1"x0.005 VHB Transfer Tape
Splice
Clear tape
Twisted Pair
PVDF
0°/270°
PVDF
Copper
Strap

FIG. 9

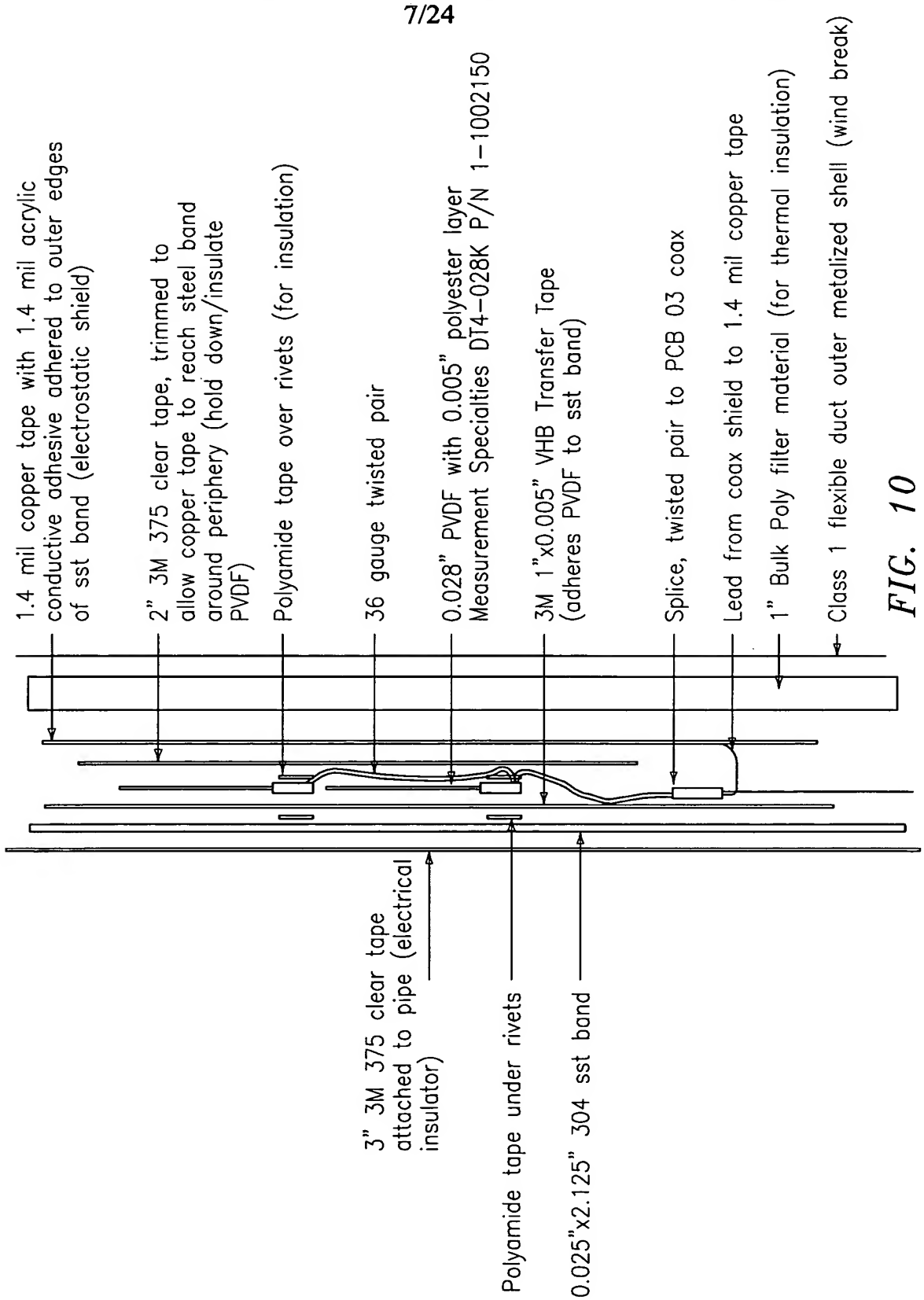
1.4 mil copper tape with 1.4 mil acrylic conductive adhesive adhered to outer edges of sst band (electrostatic shield)
2" 3M 375 clear tape, trimmed to allow copper tape to reach steel band around periphery (hold down/insulate PVDF)
Polyamide tape over rivets (for insulation)
36 gauge twisted pair
0.028" PVDF with 0.005" polyester layer Measurement Specialties DT4-028K P/N 1-1002150
3M 1"x0.005" VHB Transfer Tape (adheres PVDF to sst band)
Splice, twisted pair to PCB 03 coax
Lead from coax shield to 1.4 mil copper tape
1" Bulk Poly filter material (for thermal insulation)
Class 1 flexible duct outer metalized shell (wind break)
3" 3M 375 clear tape attached to pipe (electrical insulator)
Polyamide tape under rivets
0.025"x2.125" 304 sst band

FIG. 10

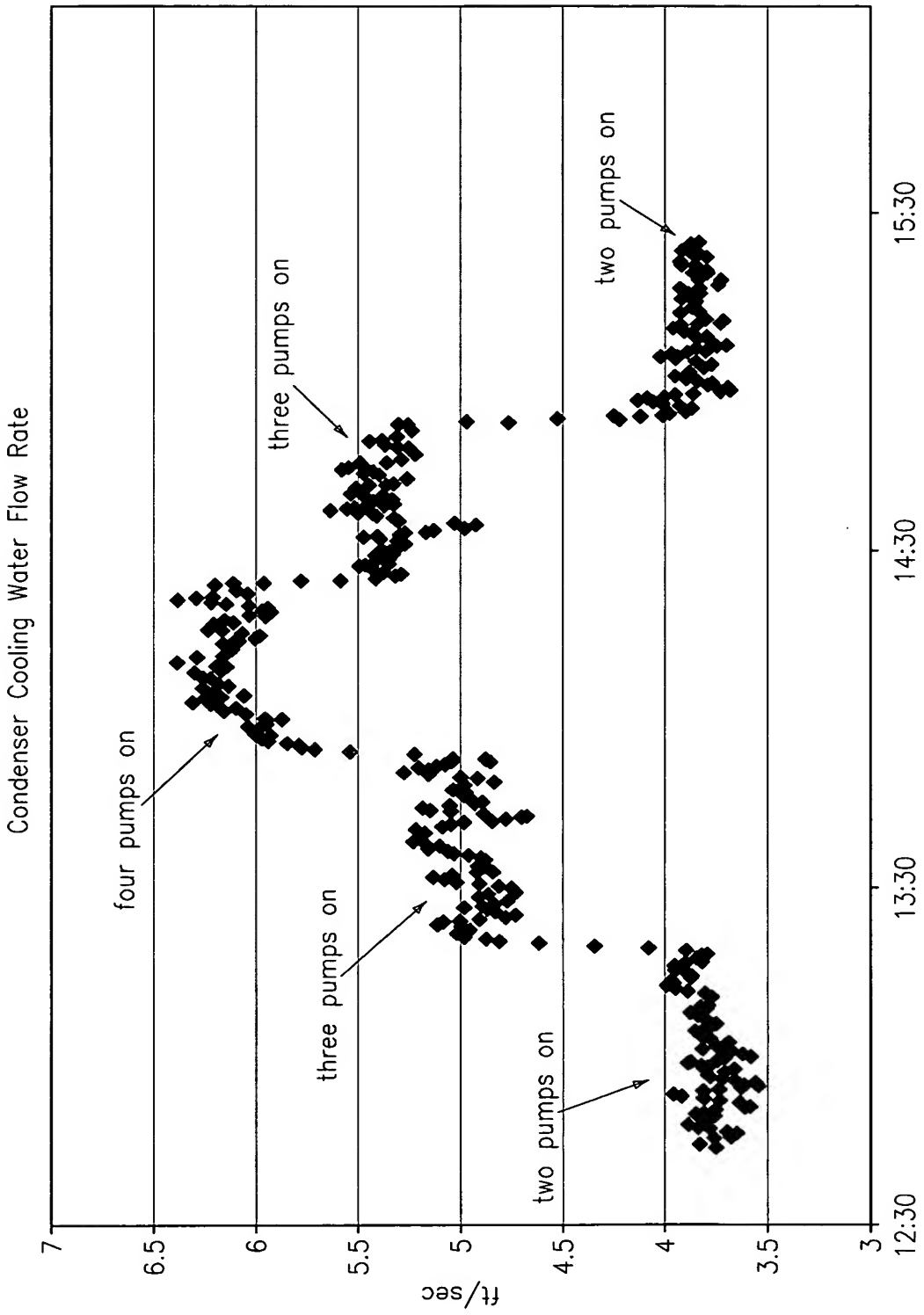
Condenser Cooling Water Flow Rate
four pumps on
three pumps on
two pumps on
three pumps on
two pumps on
ft/sec
7
6.5
6
5.5
5
4.5
4
3.5
3
12:30
13:30
14:30
15:30
Time

FIG. 11

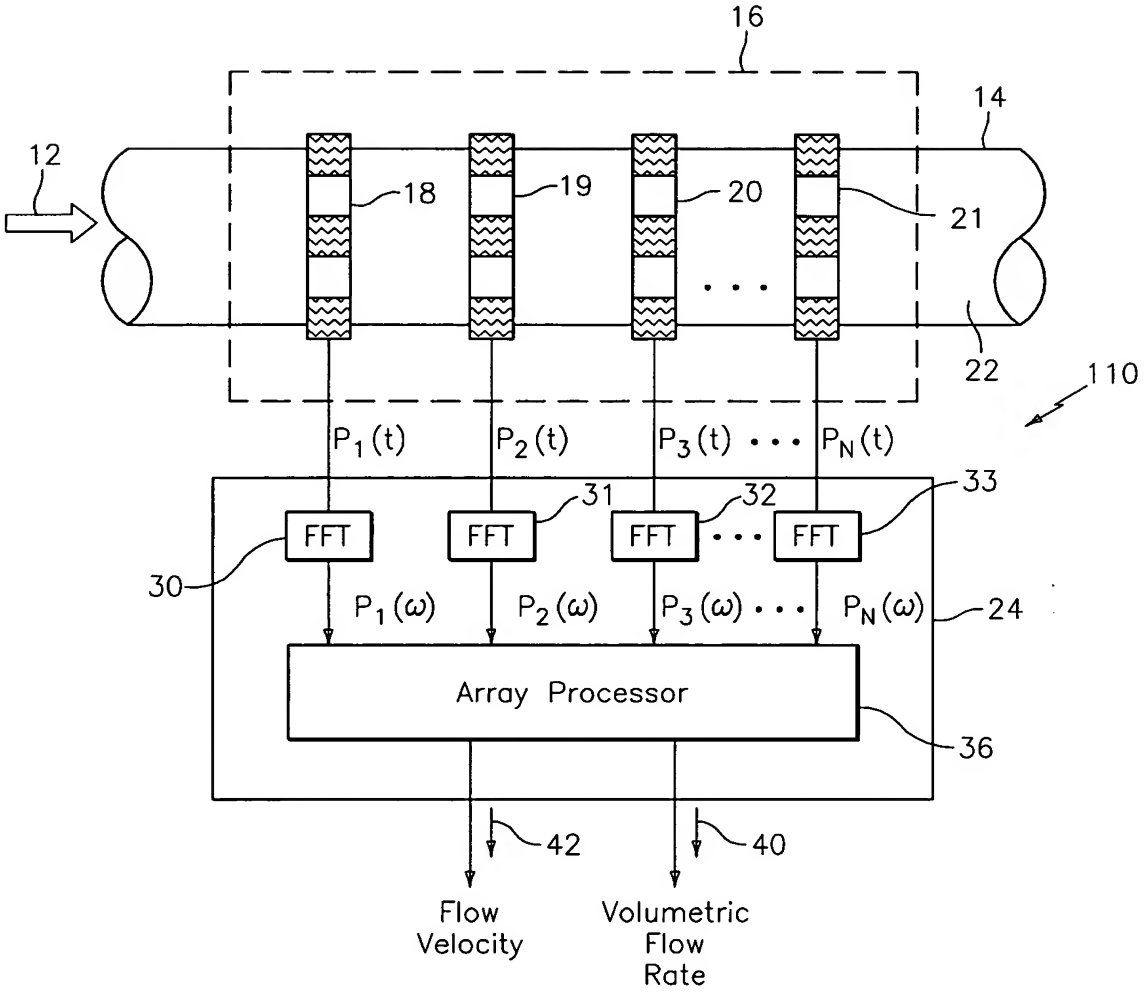
16
14
12
18
19
20
21
22
110
$P_1(t)$
$P_2(t)$
$P_3(t)$ • • • $P_N(t)$
31
32
33
FFT
FFT
FFT
FFT
30
$P_1(\omega)$
$P_2(\omega)$
$P_3(\omega)$ • • • $P_N(\omega)$
24
Array Processor
36
42
40
Flow Velocity
Volumetric Flow Rate

FIG. 12

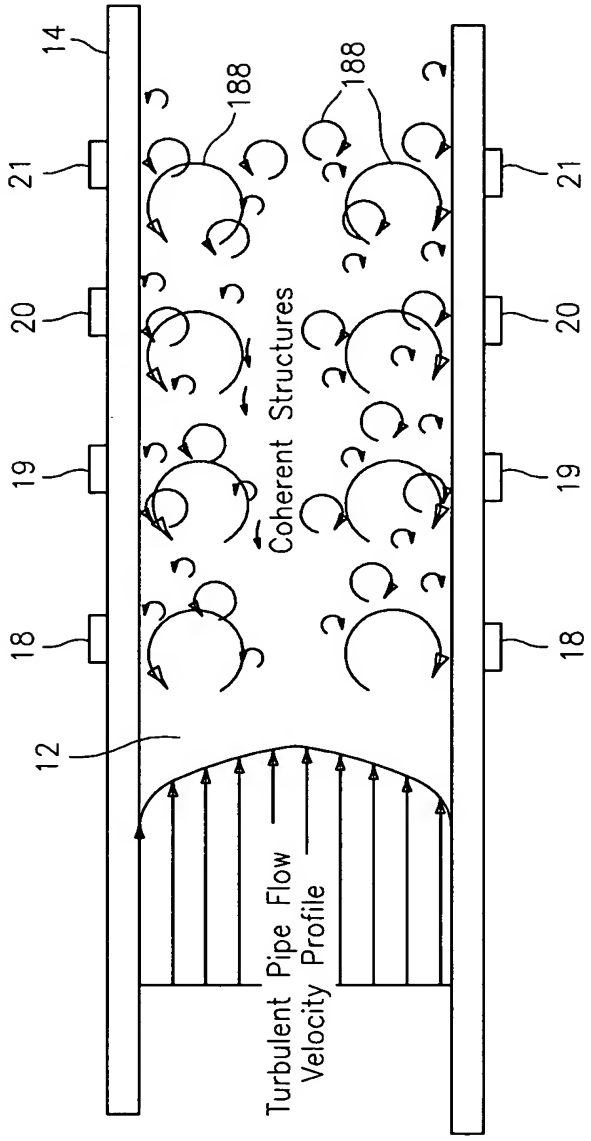
14
188
188
21
21
20
20
19
19
18
18
12
Coherent Structures
Turbulent Pipe Flow
Velocity Profile

FIG. 13

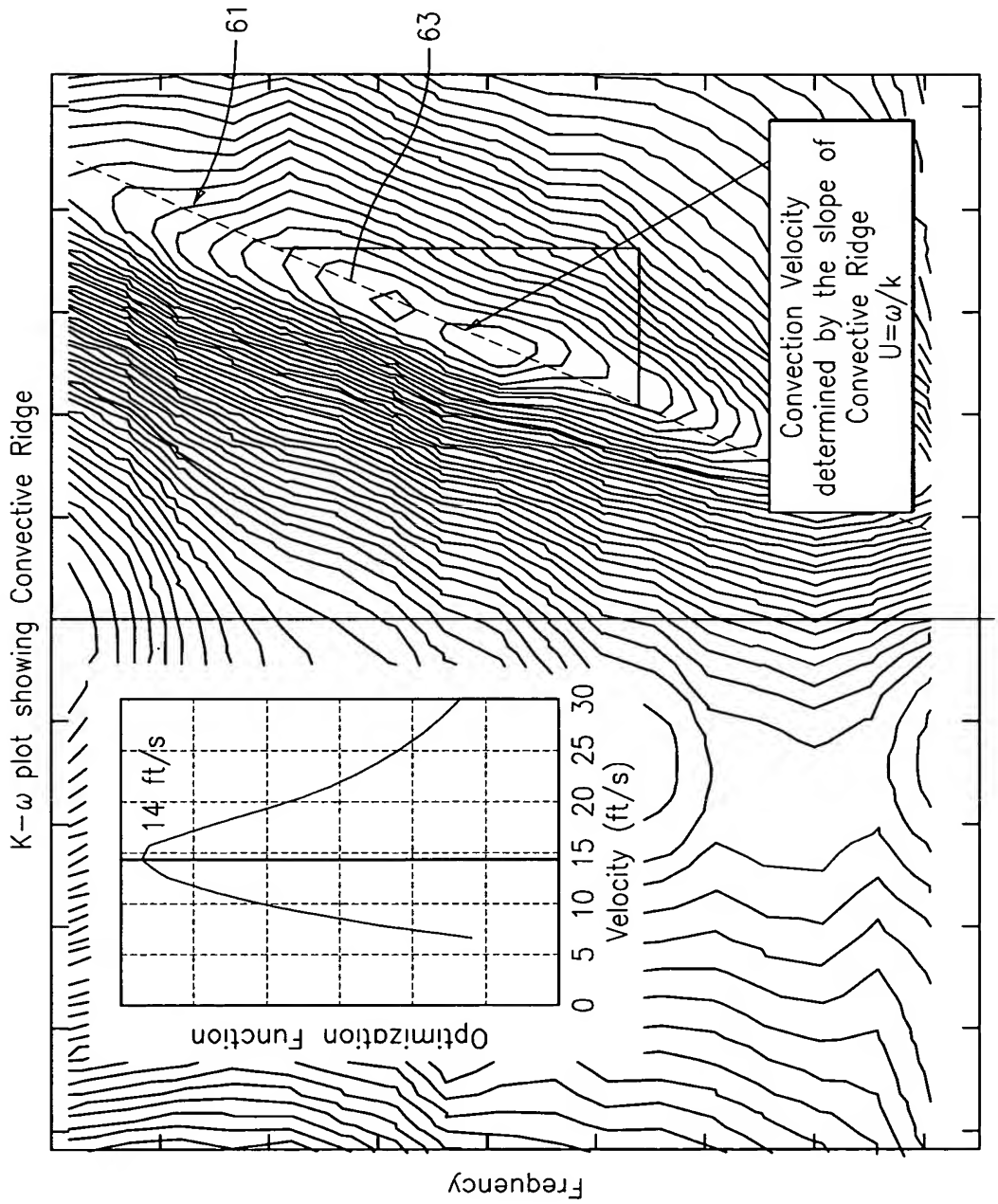
61
63
K-ω plot showing Convective Ridge
Convection Velocity determined by the slope of Convective Ridge U=ω/k
Optimization Function
14 ft/s
0 5 10 15 20 25 30
Velocity (ft/s)
Frequency
0
Wave Number

FIG. 14

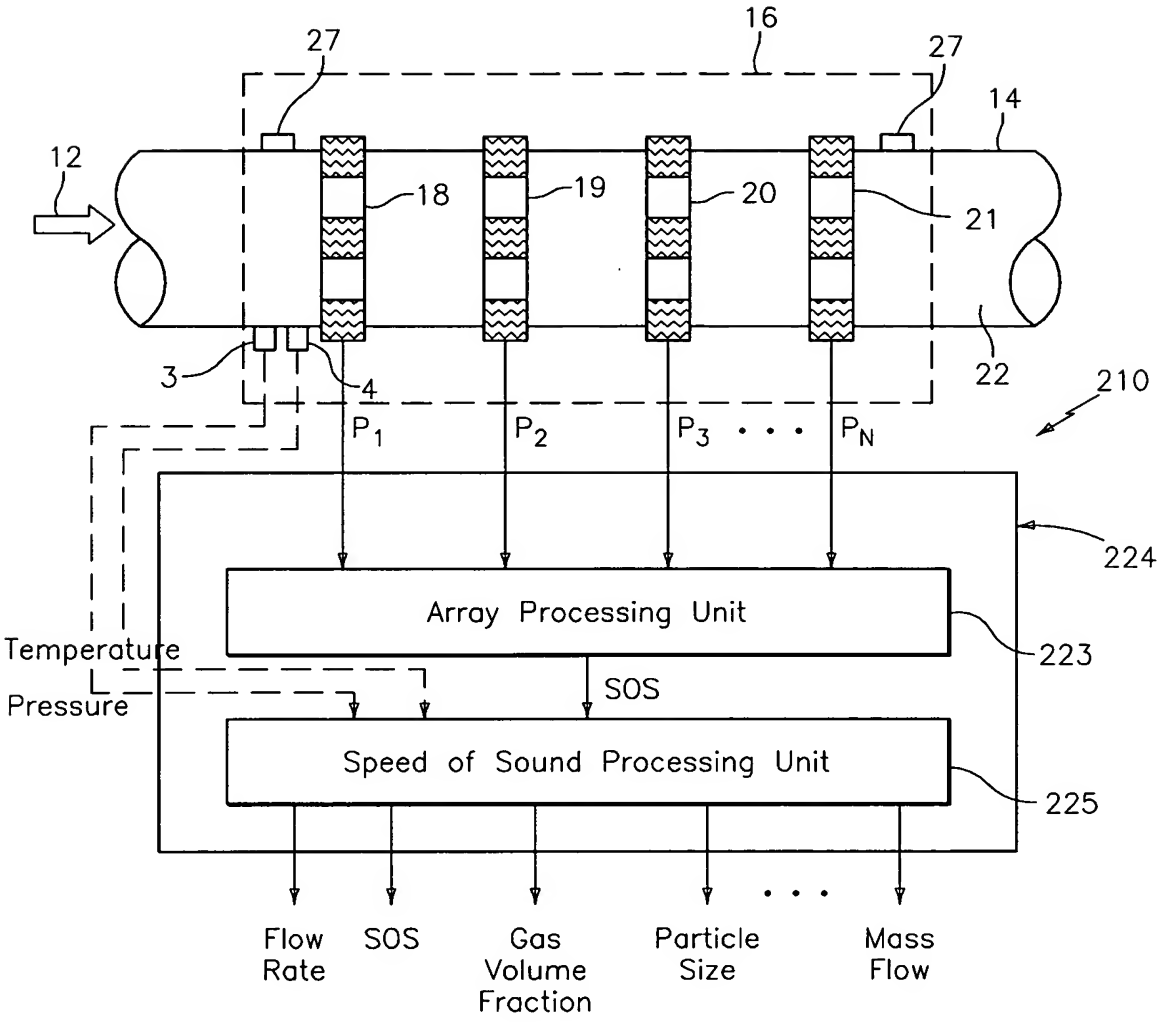
16
27
27
14
12
18
19
20
21
3
4
22
210
P_1
P_2
P_3 • • •
P_N
224
Array Processing Unit
223
Temperature
Pressure
SOS
Speed of Sound Processing Unit
225
• • •
Flow Rate
SOS
Gas Volume Fraction
Particle Size
Mass Flow

FIG. 15

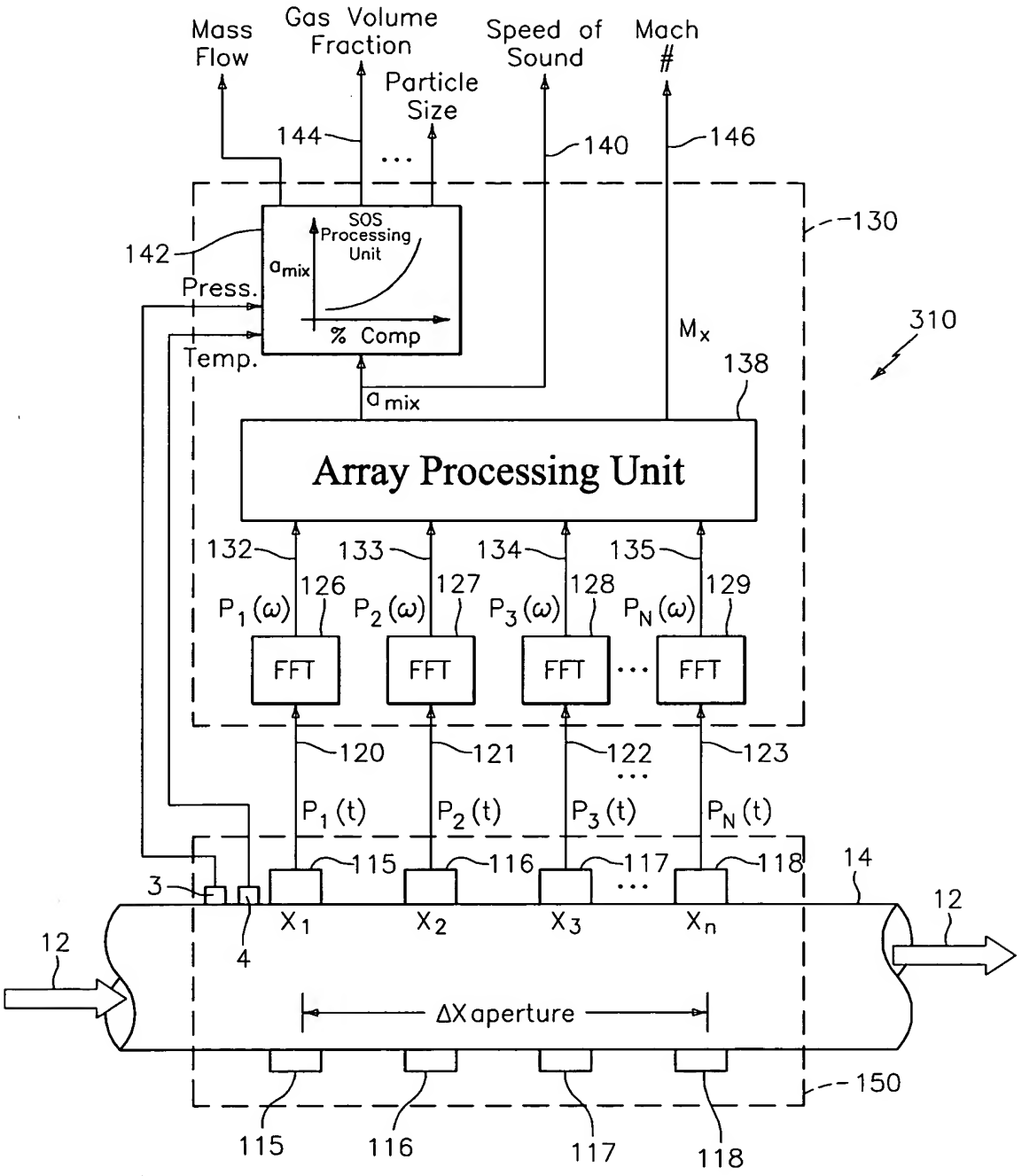
Mass Flow
Gas Volume Fraction
Particle Size
Speed of Sound
Mach #
144
140
146
130
142
SOS Processing Unit
a_{mix}
Press.
Temp.
% Comp
M_x
310
138
a_{mix}
Array Processing Unit
132
133
134
135
126
127
128
129
$P_1(\omega)$
$P_2(\omega)$
$P_3(\omega)$
$P_N(\omega)$
FFT
FFT
FFT
FFT
120
121
122
123
$P_1(t)$
$P_2(t)$
$P_3(t)$
$P_N(t)$
115
116
117
118
14
3
4
X_1
X_2
X_3
X_n
12
12
ΔX aperture
150
115
116
117
118

FIG. 16

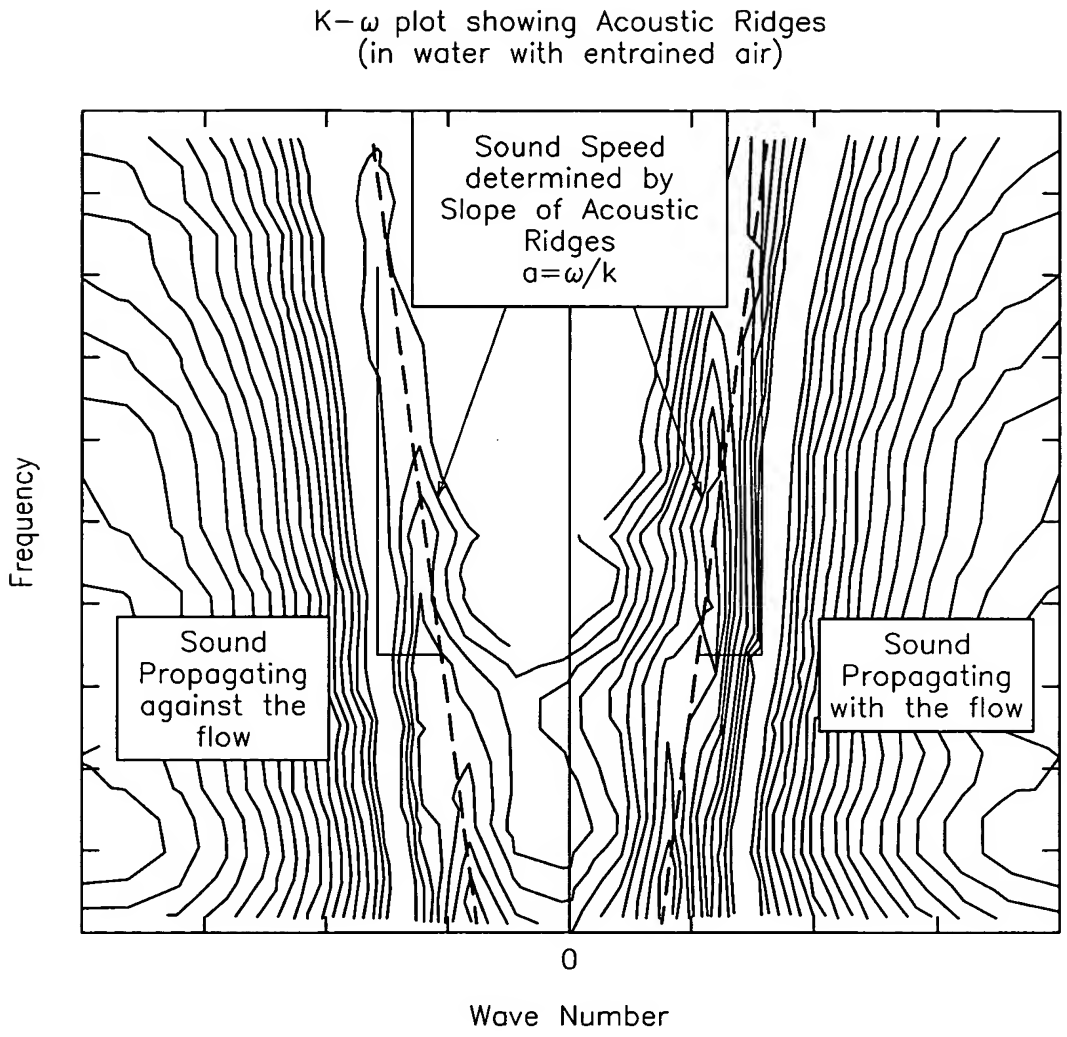
K−ω plot showing Acoustic Ridges
(in water with entrained air)
Sound Speed determined by Slope of Acoustic Ridges a=ω/k
Sound Propagating against the flow
Sound Propagating with the flow
Frequency
0
Wave Number

FIG. 17

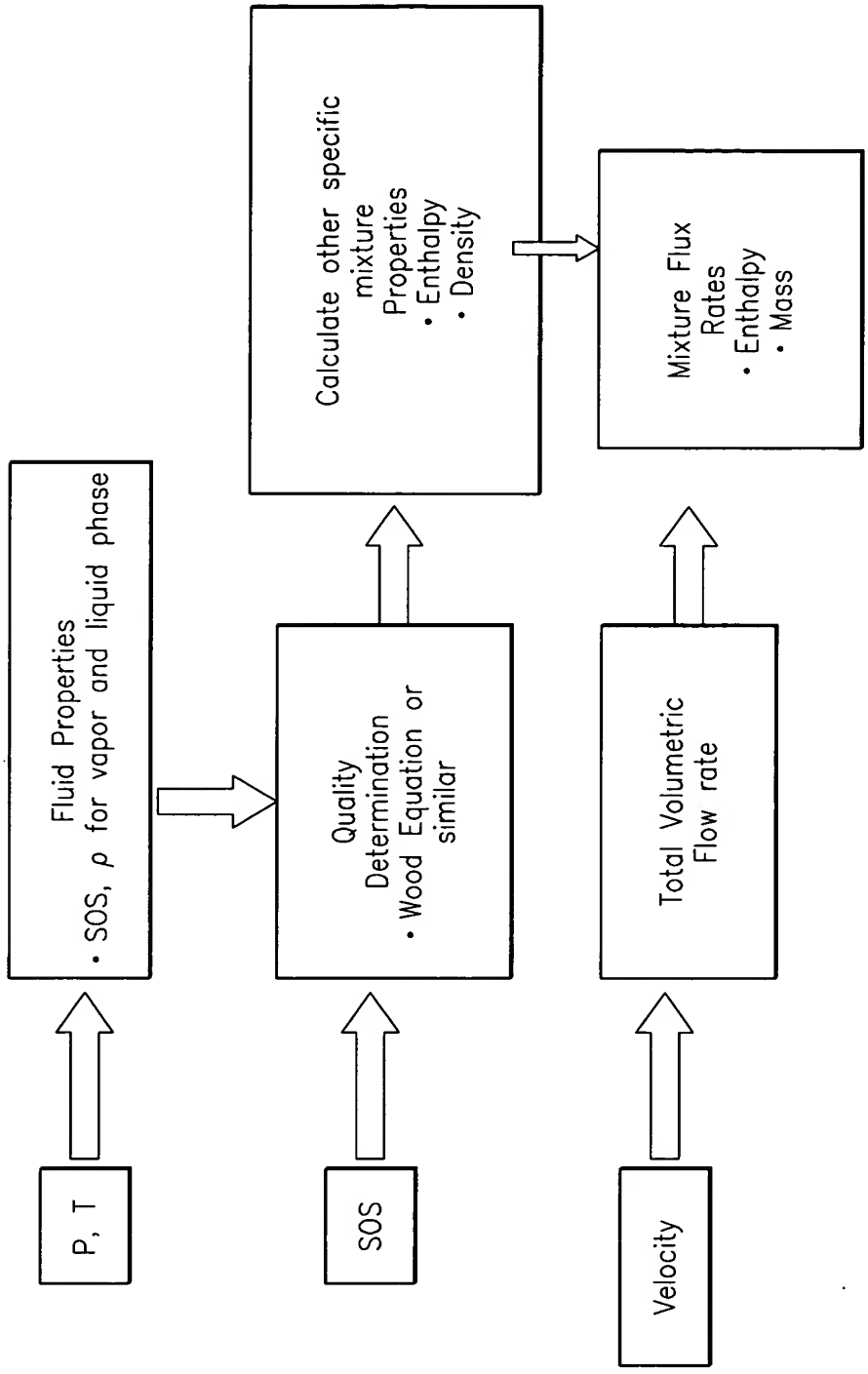
P, T
SOS
Velocity
Fluid Properties
• SOS, ρ for vapor and liquid phase
Quality
Determination
• Wood Equation or
similar
Total Volumetric
Flow rate
Calculate other specific
mixture
Properties
• Enthalpy
• Density
Mixture Flux
Rates
• Enthalpy
• Mass

FIG. 18

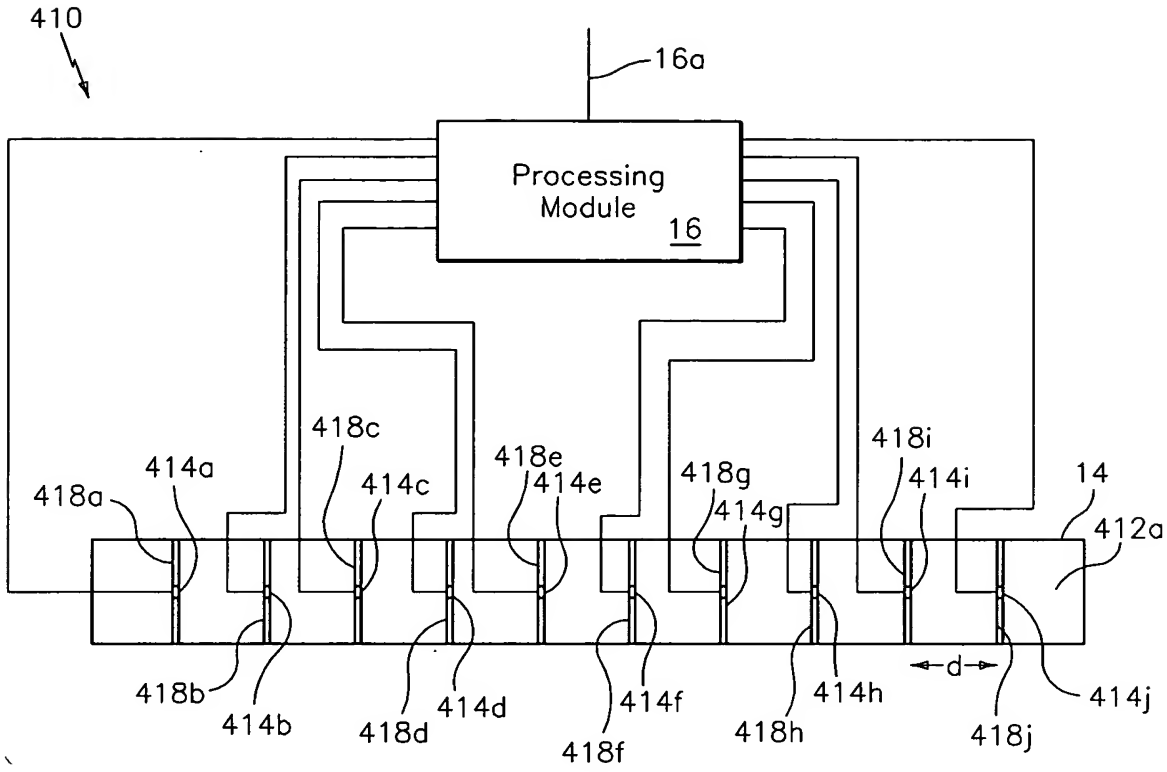
410
16a
Processing Module
16
418a
414a
418c
414c
418e
414e
418g
414g
418i
414i
14
412a
418b
414b
418d
414d
418f
414f
418h
414h
d
418j
414j

FIG. 19

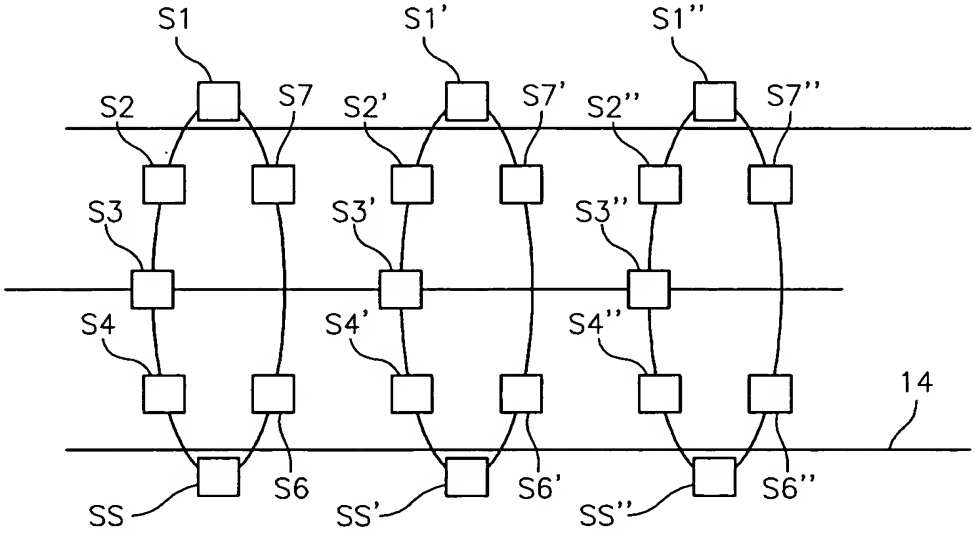
S1
S1'
S1''
S2
S7
S2'
S7'
S2''
S7''
S3
S3'
S3''
S4
S4'
S4''
14
SS
S6
SS'
S6'
SS''
S6''

FIG. 20

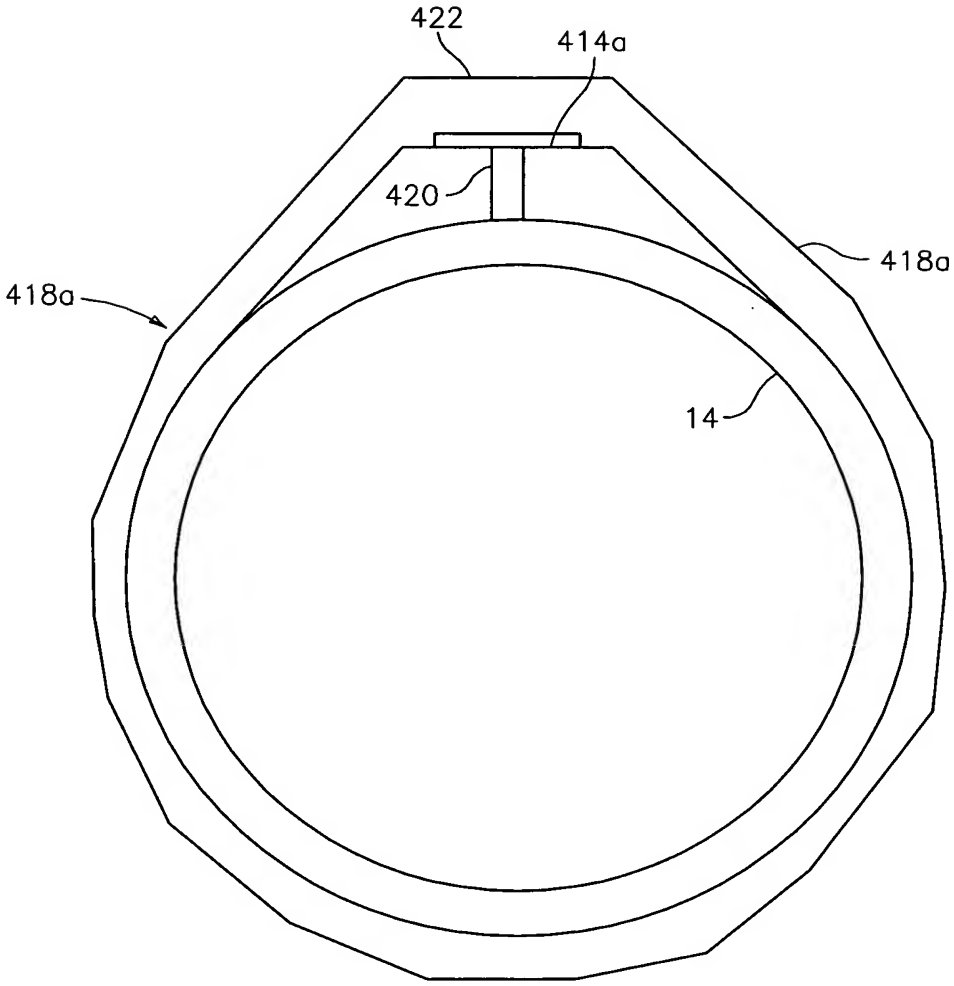

FIG. 21

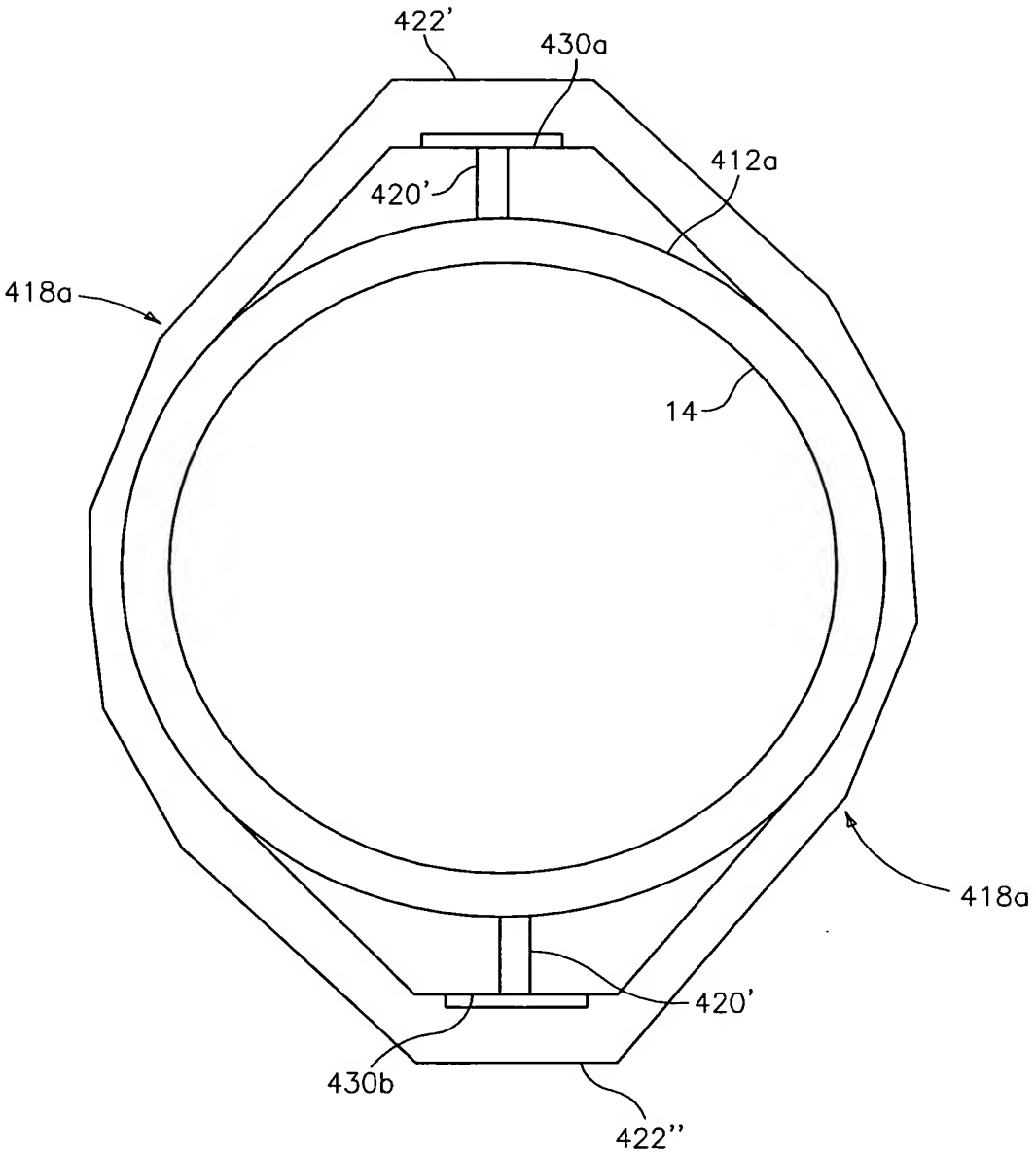

FIG. 22

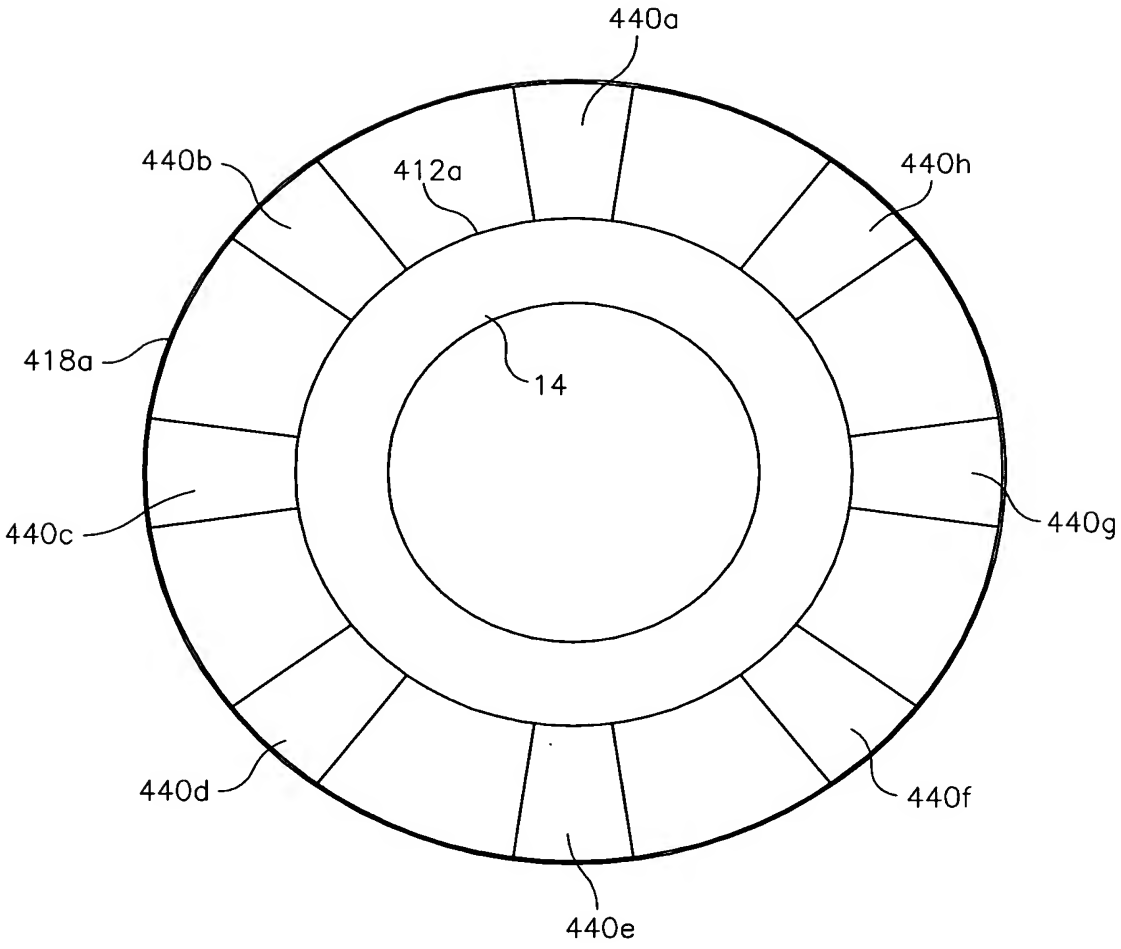

FIG. 23

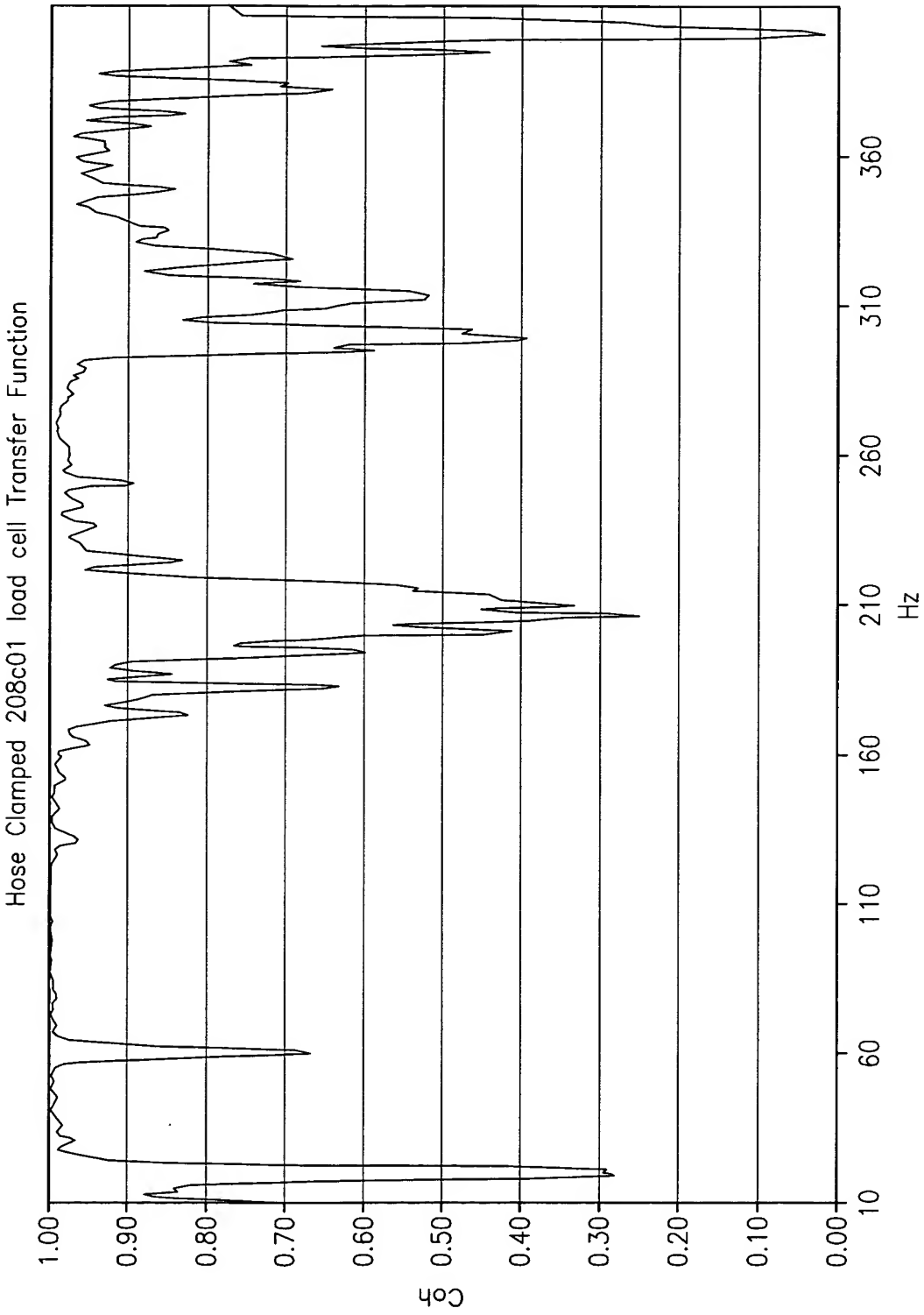
Hose Clamped 208c01 load cell Transfer Function
Coh
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
10
60
110
160
210
260
310
360
Hz

FIG. 24

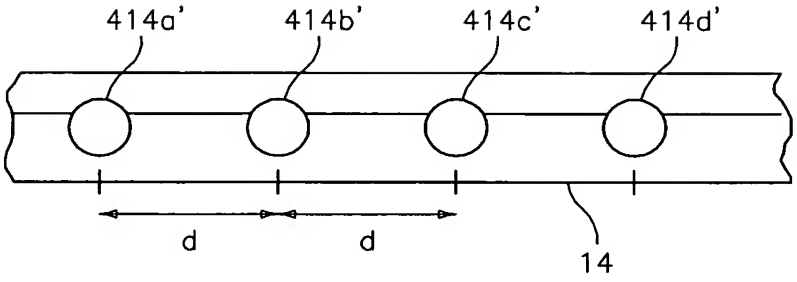
414a'
414b'
414c'
414d'
d
d
14

FIG. 25

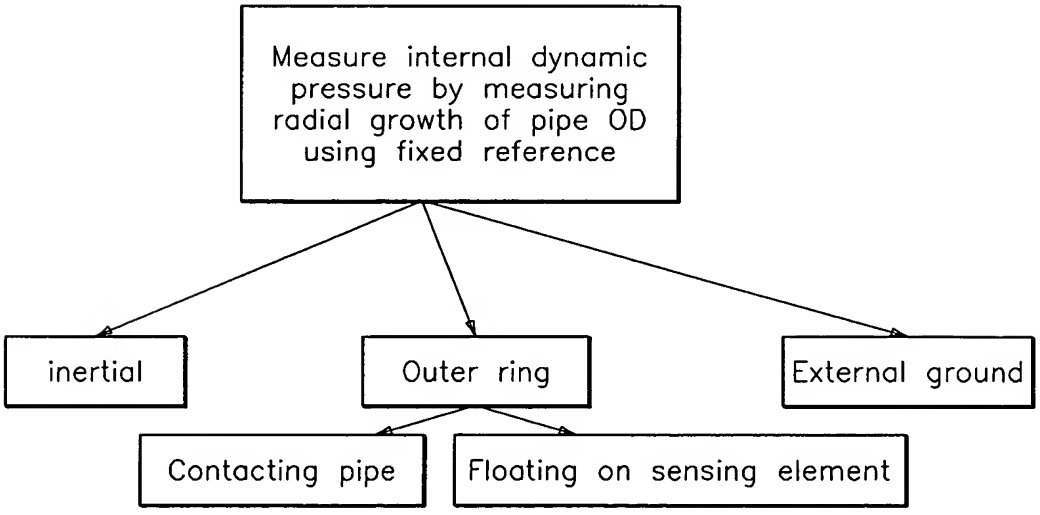
Measure internal dynamic pressure by measuring radial growth of pipe OD using fixed reference
inertial
Outer ring
External ground
Contacting pipe
Floating on sensing element

FIG. 26

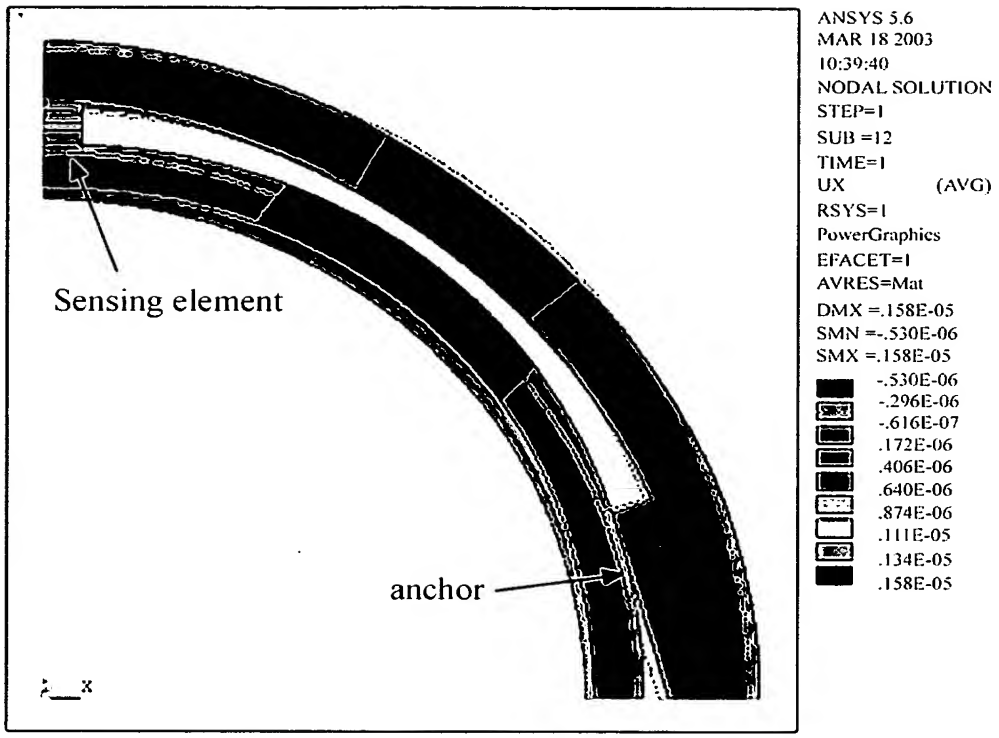
Sensing element
anchor
Y
X
ANSYS 5.6
MAR 18 2003
10:39:40
NODAL SOLUTION
STEP=1
SUB =12
TIME=1
UX (AVG)
RSYS=1
PowerGraphics
EFACET=1
AVRES=Mat
DMX =.158E-05
SMN =-.530E-06
SMX =.158E-05
-.530E-06
-.296E-06
-.616E-07
.172E-06
.406E-06
.640E-06
.874E-06
.111E-05
.134E-05
.158E-05

FIG. 27

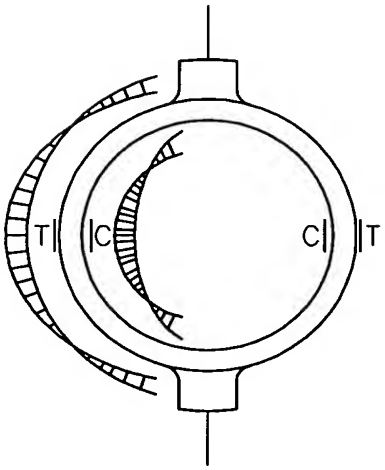

FIG. 28

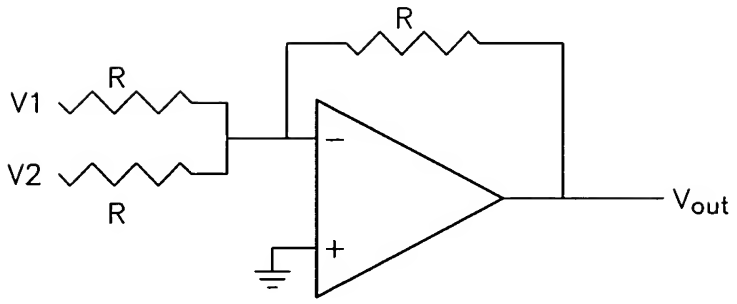

FIG. 29

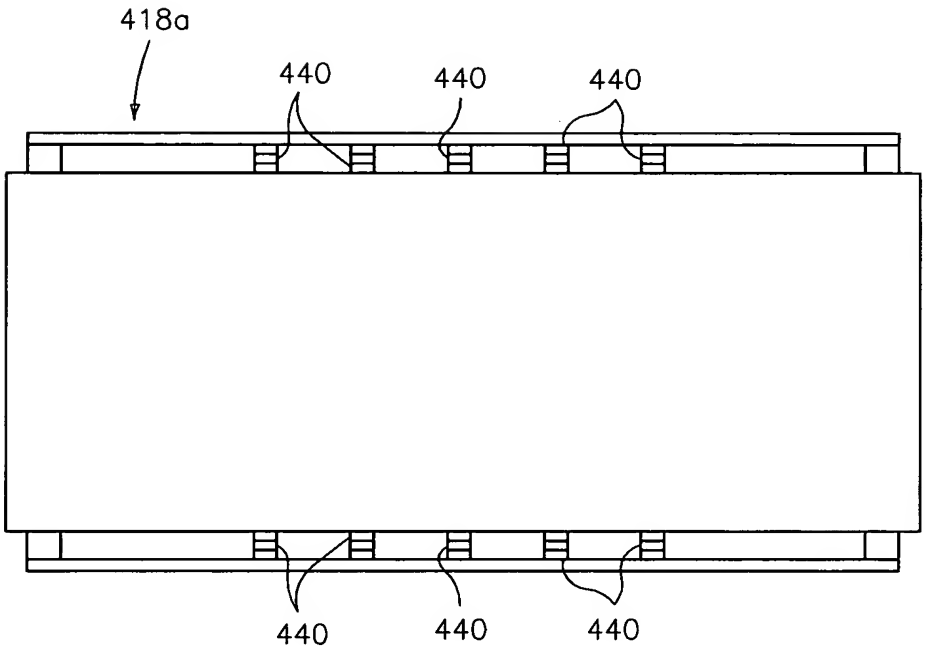

FIG. 30